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RUNNING RIGGING: THE BASICS

INTRODUCTION TO MODERN ROPE TECHNOLOGY

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INTRODUCTION

When it comes to the sailing systems onboard your boat, not many things are more important than your running rigging. So, the selection of your ropes should be made carefully with full knowledge of the options available to you. In the following document, we will introduce you to some of the basic concepts of modern rope technology and how to go about choosing the right lines for each of the primary applications.

A) RUNNING RIGGING SELECTION - WHERE TO START?

There are a few basic questions you will need to answer before it is possible to decide on the correct running rigging for your needs:

What size is your boat?
Once you get to a certain boat size (around 45ft) you should consider Dyneema® as your baseline specification, but below 45ft, lower-priced, polyester ropes can still deliver adequate performance and give you a wider range of options.

What type of boat do you have?
Multihulls have different needs to heavy, traditional cruising boats or lightweight, modern club racers and your boat type will have a significant impact on the demands placed on your running rigging. The impact different hull types will have on overall rigging loads, responsiveness and sensitivity to stretch will affect the cost vs benefit of the different running rigging options.

What are your specific needs/objectives?
This is the most critical consideration and one that is important to think through, in detail, for each of the main rope applications e.g. halyards, sheets or control lines etc. Common issues are: slipping through clutches, too much stretch, chafing points, aggressive winch drums, problems with small masthead sheaves or the need to reduce weight or windage. There are a large variety of rope finishes and treatments which can be tailored to manage many of these issues and help zero in on the right rope to meet your specific needs.

Decision-making process
As with most things in life, "you get what you pay for" and running rigging is no exception. For each of the main running rigging applications (sheets, halyards, control lines, etc.) there will be 3 levels to your available options and decision-making process:

- Core - Appropriate core groups to meet general needs
- Braid - Specific finishes to deal with the application and any known “issues”
- Budget

B) CORE

The baseline for most modern ropes is a Polyester core. This high strength, low weight fibre, has low water absorption and is available, at very reasonable prices. This is the default choice for the majority of cruising boats under 45ft.

Next on the spectrum comes some blended cores which combine basic grade (SK75) Dyneema® with polypropylene, gradually moving up to full Dyneema® cores. The blended cores tend to be good for 45-65ft cruising boats, beyond which the performance minimum should be an SK78 core.

More performance-orientated race boats, at any size, should opt for a pure Dyneema® core. There are many different qualities of Dyneema® on the market but the two primary Dyneema® cores used in performance ropes today are SK78 and SK99. A variety of finishes can also be applied to the core fibres to increase performance and stiffness. Rope performance and price generally increase as follows:

- SK78 plus a polyurethane coating
- SK78 plus heat setting and polyurethane coating
- SK99 plus heat setting and polyurethane coating

N.B. On performance lines, manufacturers will generally refer to either SK78 or SK99. If a manufacturer refers to generic Dyneema® this will normally refer to SK75 which has higher creep and lower fatigue resistance than SK78.

Coating the core with polyurethane reduces inter-fibre abrasion and makes splicing easier. The heat setting process involves heating the fibre and pre-stretching it to ensure perfect balance across all the fibres in the core. Applying this process increases rope strength and stiffness by 15%, whilst reducing diameter by 10%.

C) BRAID

Most rope braids use heat treated polyester as a base. Polyester fibres demonstrate high tenacity and good resistance to abrasion. Polyester braids are lightweight, absorb minimal water and are resistant to chemical/physical agents making them ideal for a wide range of applications.

Additional fibres can be used to provide the braid with different characteristics. Aramids, Technora® and Cordura® are used to increase grip and abrasion resistance for improved performance in clutches and around winches. Vectran® and Zylon® (PBO) are used to improve heat resistance in high load / speed applications. Dyneema® can be used on its own as a base braid material, or combined with other fibres to increase wear / abrasion resistance. In some highly-specialised ropes, PBO is also used as the base braid material where greater heat resistance and stiffness are required.

There are a vast number of braid combinations available and this is where you can adapt your ropes to suit the specific needs/objectives of each of your running rigging categories.

D) BUDGET

Running rigging prices vary enormously. For example, the price range for a 10mm diameter rope, from the lowest end of the performance scale to the highest can vary from €2.50 - €50 per metre. In most cases, having completed the steps outlined above, you will find yourself with 2-4 appropriate options and ultimately your choice will come down to a price vs performance judgement based on your individual preferences.

SUMMARY

- Be clear what you want to achieve and identify any specific challenges/issues
- Choose an appropriate core for your boat size and performance preferences
- Choose a cover that will tailor the rope to suit the application and any problem areas.

TERMINOLOGY

At this point, we should establish some basic terminology...

A) SINGLE BRAID

A Single braid is a braided core that has no jacket. Generally, single braids consist of a 12-strand braid of Dyneema® fibres which have been treated with a polyurethane coating to resist abrasion, improve handling and maintain the rope's uniformity. Single Braids are all about maximising strength and stiffness for minimum weight. They are used as halyards and control lines on dinghies, GP race boats and extensively for loops, strops and lashings on all boats due their flexibility, ease of splicing and general handling.

A) DOUBLE BRAID

A Double braid is a core of single braid with a braided jacket. The core provides the primary strength and stiffness of the rope but the braided jackets define the handling and holding properties. There are a myriad of different fibres and fibre blends used to make outer braids grip or slip better, feel softer or harder to the hand and increase abrasion or heat resistance depending on the specific application.

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C) ROPE STRENGTH

Strength of ropes is generally measured in daN (Dekanewtons) where 1 daN = 10 N of force. But why do rope makers use daN where most marine equipment manufacturers use kilograms (kg) for working / break loads? The use of kilograms is NOT technically correct – it should really be kilogram-force but this is abbreviated by most suppliers to just kg. We suspect kg is considered an easier unit for customers to understand, but N or daN is technically a more accurate way to describe the force required to break a fitting or rope.

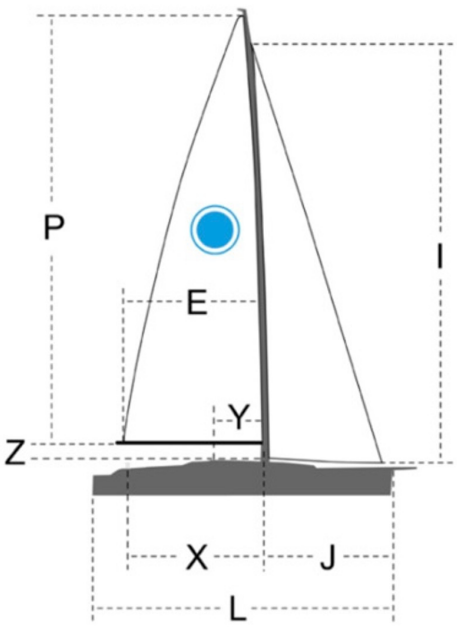
It is very difficult to specify the break load of a rope as it depends on how the rope is terminated or secured for the test. Most reputable rope makers specify the “spliced strength” of the rope, but this is completely dependent on the quality of the splice and the radius of the pin used on the test bench. Therefore, all rope break strengths are “nominal” values but can be used to show relative strength between different ropes from the same manufacturer.

In conclusion, 10 daN is equivalent to 10.19 kgf and given the nominal nature of rope break loads, daN and kg can be safely assumed to be equivalents when it comes to specifying compatible hardware and running rigging.

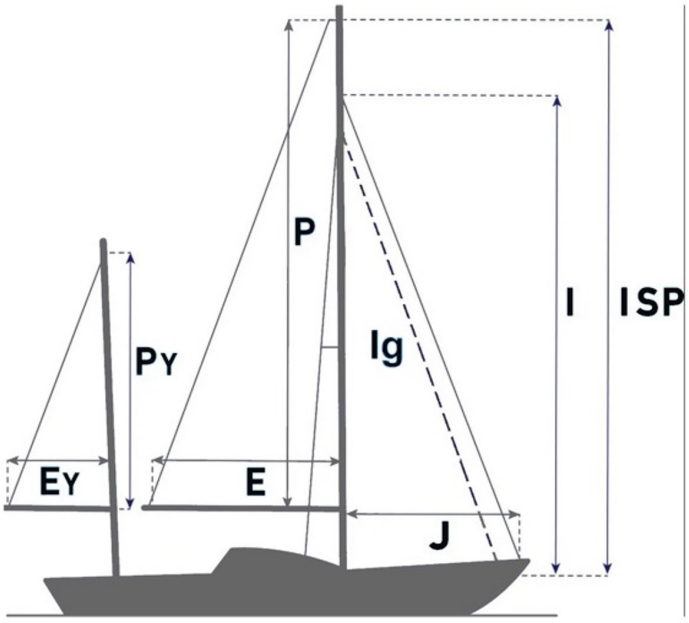
CALCULATING RIGGING LENGTHS

Once you have established a suitable core/cover for your running rigging application, you need to know what length to make your sheet or halyard. The simplest solution is to copy the existing line in terms of length and terminations. However, in the absence of this choice, you will need to determine the correct length. Getting the length right is important. Obviously, if your sheet or halyard is too short, it does not get you anywhere! However, a rope that is too long increases the chances of getting tangled, adds to the overall weight of the boat and is just a waste of money!

The majority of the lines onboard can be determined from basic rig data which is also commonly used by sailmakers to determine sail sizes:



P/Py = Main / Mizzen hoist length
E/Ey = Main / Mizzen foot length
X = Primary/Genoa winch to mast
Y = Halyard winch to mast
Z = Boom above deck



I (Ig) = Height of (Inner) Forestay above deck
ISP = Height of Spinnaker halyard above deck
J = Front of mast to base of forestay
L = Length overall

From this rig geometry data there are some basic formulas used to derive running rigging lengths:

Halyards			
Main 1:1*	2.1 x P + Z + Y + 1	Main 1:1$	2.1 x P + 2
Main 2:1*	3.2 x P + Z + Y + 1	Main 2:1$	3.2 x P + 2
		Mizzen 2:1$	2.1 x Py + 2
Genoa *	2.1 x I + Y + 1	Genoa$	2.1 x I +1
Spi/Code0/Gen*	2.1 x Isp + Y + 2	Spi/Code0/Gen$	2.1 x Isp + 2
Staysail*	2.1 x Ig + Y + 1	Staysail$	2.1 x Ig + 1
N.B. * Halyard winch on coachroof		$ Halyard winch on mast	
Sheets			
Jib	L	Genoa	1.5 x L
Gennaker	2.5 x L	Spinnaker Sheet/Guy	2.1 x L
Other			
Main Reef 1†	0.24 x P + E + Z + Y + 2	Main Reef 2‡	0.48 x P + E + Z + Y + 2
Mizzen Reef 1†	0.24 x Py + Ey + Z + Y + 2	Mizzen Reef 2‡	0.48 x Py + Ey + Z + Y + 2
Mooring (Bow/Stern)	0.5 x L	Mooring (Spring)	L
N.B. † Assumes Reef 1 at 12% of P		‡ Assumes Reef 2 at 24% of P	

Each of the above formulae includes some margin for error however, if in doubt, it is always better to add on 1-2 meters than try to cut it too short!

SPLICING

A knot will normally reduce the break strength of a line by approx. 20-40% (Reference Wikipedia) whereas a correctly made splice is capable of attaining the ropes full strength. Knots on halyards and sheets are also significantly bulkier than a spliced loop and prone to snagging on mast, standing rigging or sails.

Therefore, it is well worth taking the time to think through any hardware requirements for the ends of your lines, in advance, and getting them spliced in, rather than tying on halyard shackles. If you are concerned about the additional costs of having your ropes made by a professional rigger, why not learn to do the splicing yourself? Modern ropes are specifically designed to be easy to splice and there are many books and online video tutorials which can help you to pick up the basics. Learning to splice is a key sailing skill and once you have gained confidence, it will open up all sorts of opportunities for optimising your running rigging systems. It only requires a few inexpensive tools and will give you great satisfaction.

ROPE CARE AND MAINTENANCE

Salt crystals and dirt tear away at rope fibres. ‘Salty ropes’ are damp, thus collect more dirt which, left unmanaged, will significantly shortening their lifespan…. Ropes are an essential component of your sailing systems and proper maintenance will ensure you get the maximum performance and value from your investment.

Regular cleaning of your lines will also keep them more supple and easier to handle. This is especially the case for ropes in constant use, such as genoa and mainsheets.

A) REGULAR MAINTENANCE

After every weekend cruise or regatta, when you get back to the dock you should rinse your lines thoroughly with a freshwater hose and then leave them in a position where they can dry out.

B) ANNUAL MAINTENANCE

Once a year you should remove all lines from the boat and give them a thorough clean. Only use cold water and detergents with pH values between 8-9 which (which in simple terms, means washing up liquid or soft detergent). There are several ways this can be achieved:

Rinse:
Lay the ropes on the deck or driveway, rinse them with water and then rub in the detergent, working it into the rope along its length. Thoroughly remove all detergent with plenty of freshwater.

Soak:
Place the ropes in a large container / bath with some detergent and leave them to soak for 24 hours. Then rinse thoroughly whilst scrubbing away any remaining dirt with a brush.

Machine Wash:
It is fine to put ropes on a cold wash (16°C / 60°F) with a slow spin cycle. Place the lines in a pillowcase or mesh bag to prevent tangling

Drying:
Heat damages rope, particularly modern Dyneema®, where its break strength can be significantly reduced with too much heat. Therefore, it is critical that only cold water is used throughout the cleaning process, and you DO NOT use a tumble drier or fan heater to dry the lines. Let them drain / dry naturally in fresh air e.g. on a cloth's line.

CONCLUSION

There is huge choice available in the market for yachting ropes, which can be confusing. Hopefully the above guide has given you enough information to allow you to determine some of the key factors involved. At the very least, you will have an idea of the relevant information we will need to help you make the right selection, based on your set of specific needs.

Further resources available:

RUNNING RIGGING RESOURCES

Click to access our Running Rigging resources page with detailed information on our partners and additional blogs to help you to choose the correct lines for your boat.

RUNNING RIGGING RESOURCES

CUSTOM SPLICED LINES CONFIGURATOR

All of our custom lines have a number of possible configurations. This blog will help you to understand what information you need to give us so that we can ensure you get the right ropes for your boat.

CUSTOM SPLICED LINES CONFIGURATOR

SPLICING TOOLS

Click here to see splicing tools available at Upffront.com including needles and splicing kits.

SPLICING TOOLS

ENQUIRE

If you have any questions or would like to discuss your specific needs with our technical team, please feel free to contact us at support@upffront.com or click the button.

RUNNING RIGGING ENQUIRY